Human Factors Trends in C-130 Mishaps -- Implications for Training

Dr. Bob Nullmeyer

Warfighter Training Research Division

Air Force Research Laboratory

Mesa AZ

Bob.nullmeyer@williams.af.mil

DSN 474-6283

(480) 988-6561, ext. 283

Previous C-130 CRM Research

- **Research to improve C-130 ATS CRM instruction**
  - ***Simulator crew skills study***
  - ***Accident/incident report analyses***
  - ***Student record trend analyses***
- **Products**
  - ***Specific CRM skills to guide CRM course content in C-130 ATS***
  - ***Measures to track trends***
  - ***Procedures for other applications***

C-130 CRM Research Partners

- ***DET3 AMCAOS/DOUC - Lt Col Mike Stanley***
- ***OO-ALC/YWS – Rock Bushman***
- ***Lockheed Martin***
  - ***Greg Deen***
  - ***Dave Wilson***
- ***Air Force Safety Center – Lt Col Don White***
- ***Anacapa Sciences -- Alan Spiker***
- ***AFRL/HEA -- Bob Nullmeyer***

CRM Defined (AFI 11-290)

- **"The effective use of all available resources -- people, weapon systems, facilities, equipment, and environment -- by individuals or crews to safely and efficiently accomplish an assigned mission or task.**

- **'CRM' refers to the training program, objectives, and key skills directed to this end."**

Six CRM Core Areas

Mission Evaluation: pre-mission analysis, planning, brie
replanning, debrief

Task Management: prioritize activities, time control, checklist discipline, workload management, standard operating procedures

Situation Awareness: preventing loss of SA, recognizing loss of SA, recovering from loss of SA

Crew Coordination: leadership, assertiveness, crosstalk, teamwork, conflict resolution, hazardous attitudes

Communication: listening, feedback, intracrew and external communication, information exchange

Risk Management/Decision Making: risk assessment, problem solving, emergency procedures, go/no-go decisions

A Mishap Crewmember's view of CRM

Q: How do you think the CRM was during the whole sequence?

A: "I think the rapport was phenomenal. It was great. We got along very well. XXX and I have a lot in common with our children and wives, and everything else. I mean…from the loadmaster, engineer and them, there were no conflicts at all."

Anacapa Sciences, Inc.

C-130 Study Objectives & Participants

Objectives

- Get “snapshot” of C-130 crews’ CRM proficiency
- Fold strong and weak CRM behaviors into revised CRM curriculum

Participants

- Air Force Air Mobility Command
- Air Force Research Laboratory
- Lockheed Martin Information Systems (LMIS)
- 314th Tactical Airlift Wing (LRAFB)
- 317th Operations Group (DAFB)
- Anacapa Sciences, Inc.

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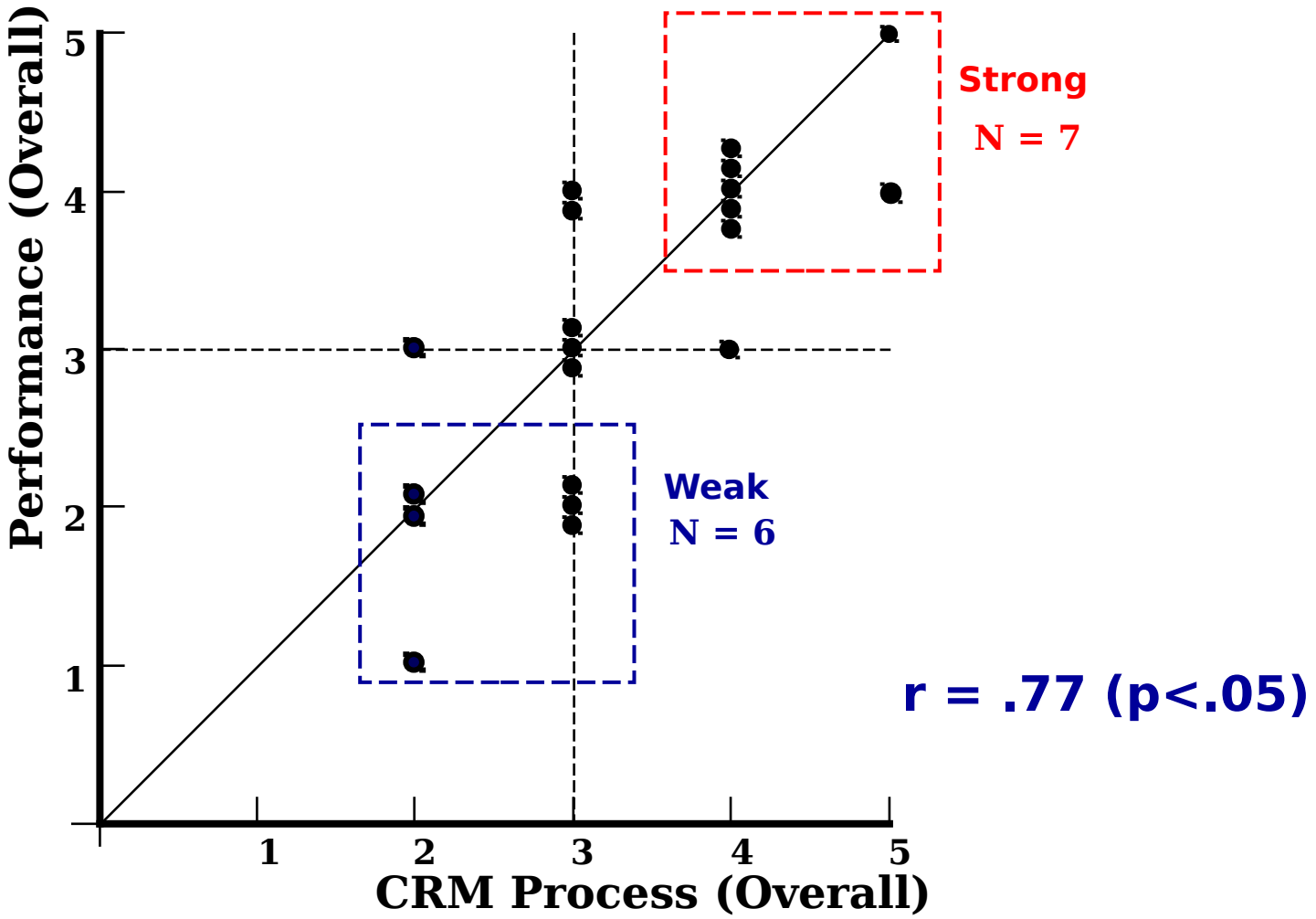
Overall CRM and Mission Performance



Each point represents one C-130 crew

CRM-Performance Relationship

Overall CRM Process – Mission Performance correla

r = .77*

strong effect consistent with other weapon systems

During mission planning, CRM-performance r = .84

During mission execution, CRM-performance r = .66

Planning quality – mission performance r = .65

CRM - mission performance effects evident at each sit

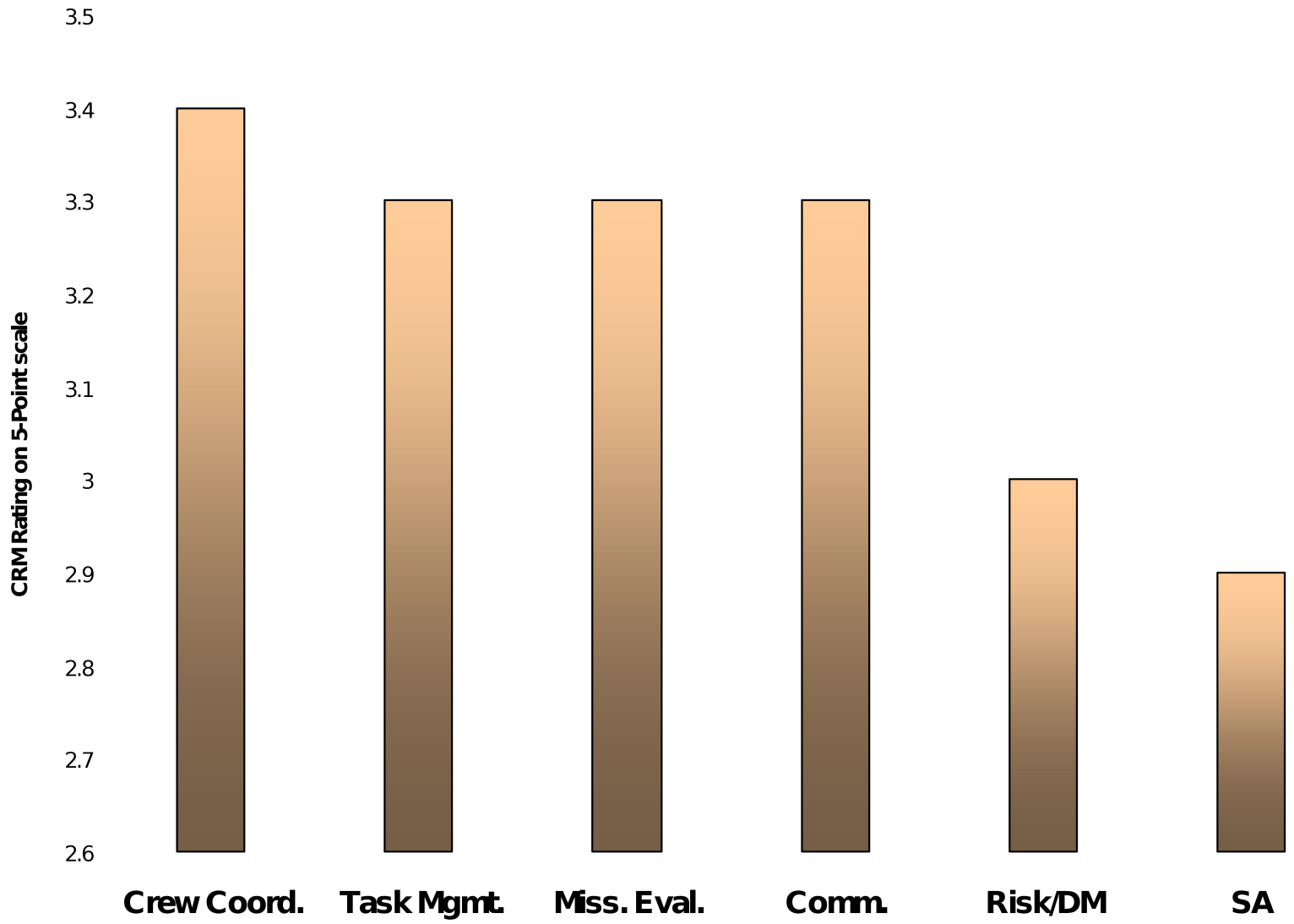
r = .61* LRAFB

r = .90* DAFB

*all p<.05 with Bonferroni adjustment

Skill Ratings for Core CRM Areas

(Based on 5-point Scale)

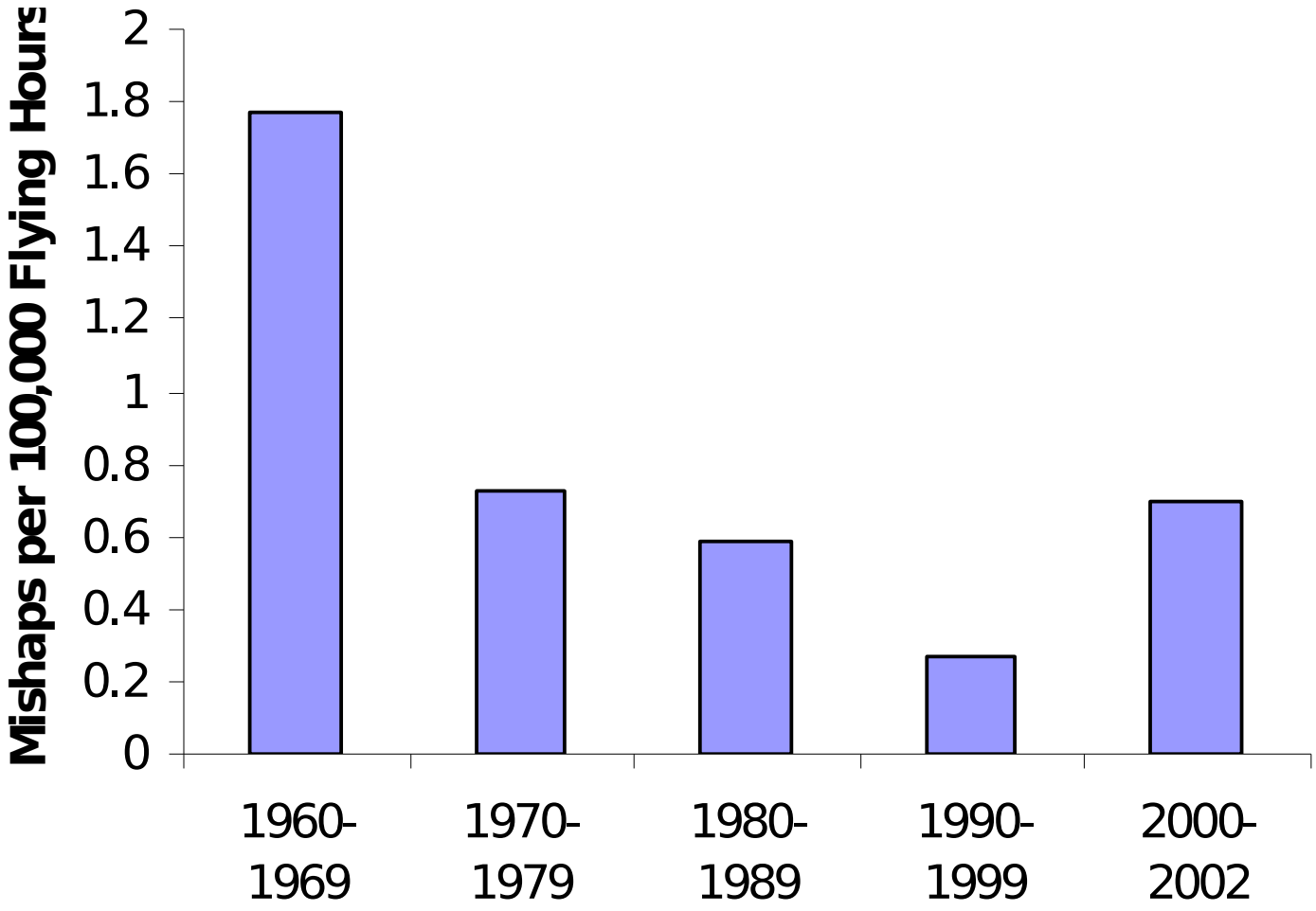


C-130 Mishap Analyses

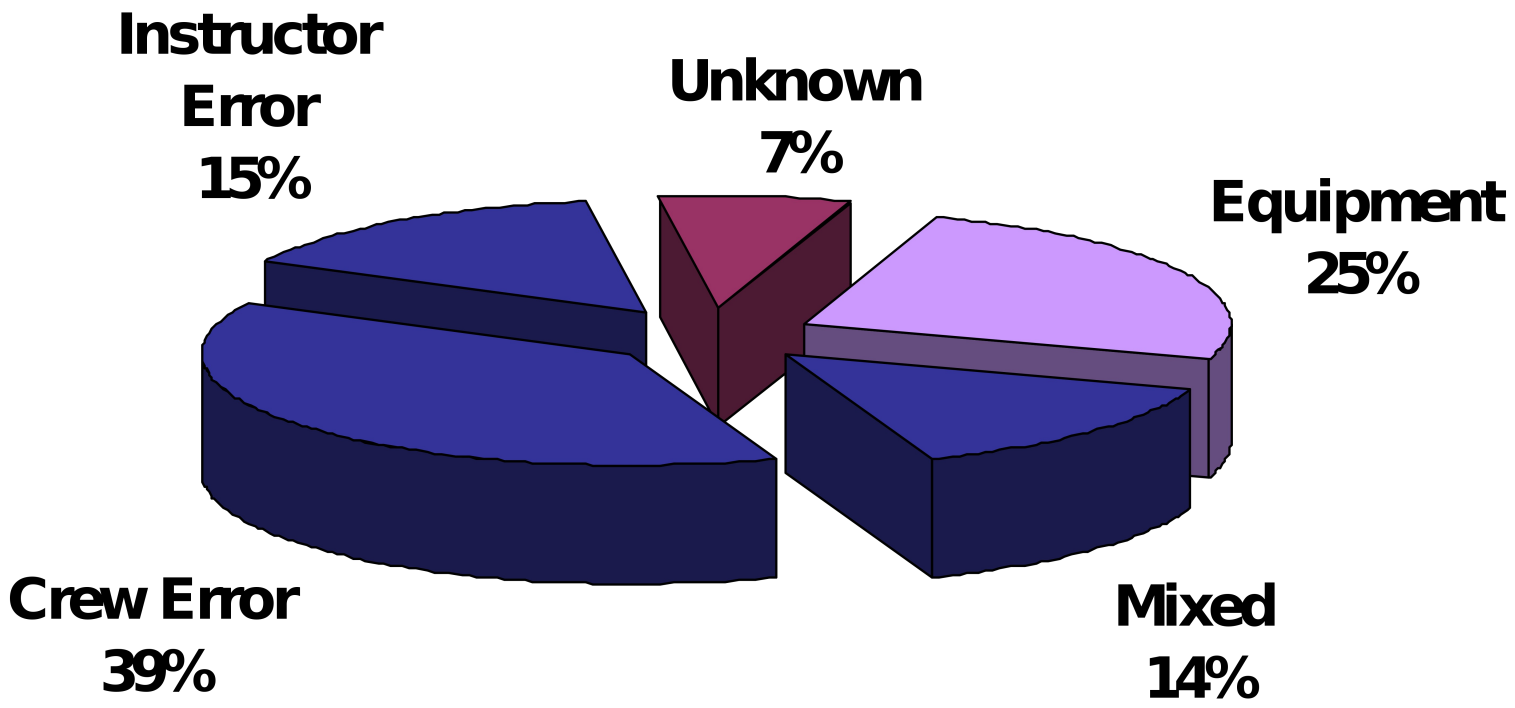
- **C-130 Class A flight mishaps**
  - ***$1 Million damage***
  - ***Fatality***
  - ***65 occurred from 1971-2002***
- **Data sources**
  - ***Air Force Safety Center home page (http://safety.kirtland.af.mil)****
  - ***Narrative database with causal and contributing factors****
  - ***Human factors databases****
  - ***Mishap reports (Tabs T and Y)***

(*Available Electronically)

C-130 Class A Mishap Rates 1960-2002

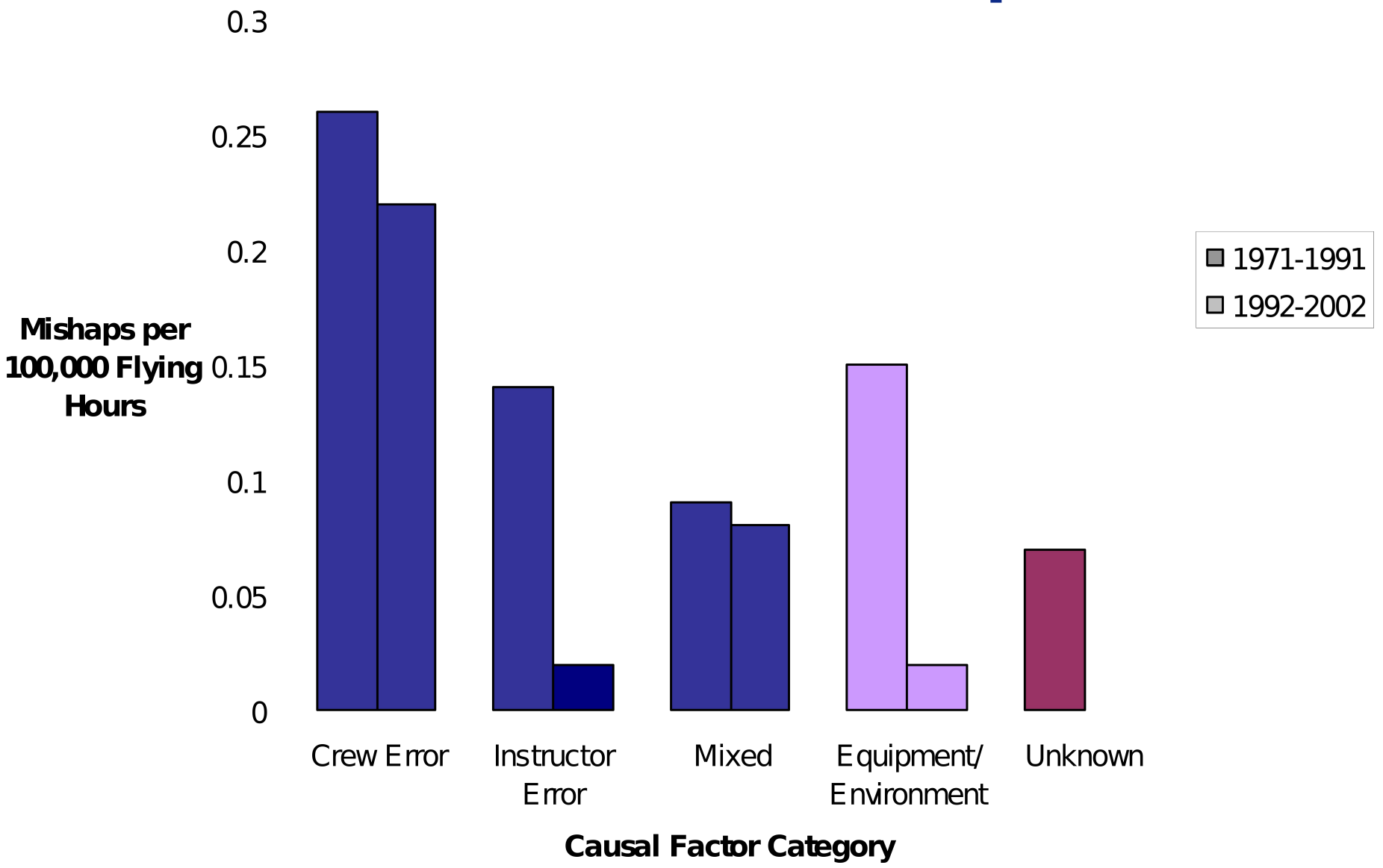


C-130 Class A Mishap Causes 1971-2002

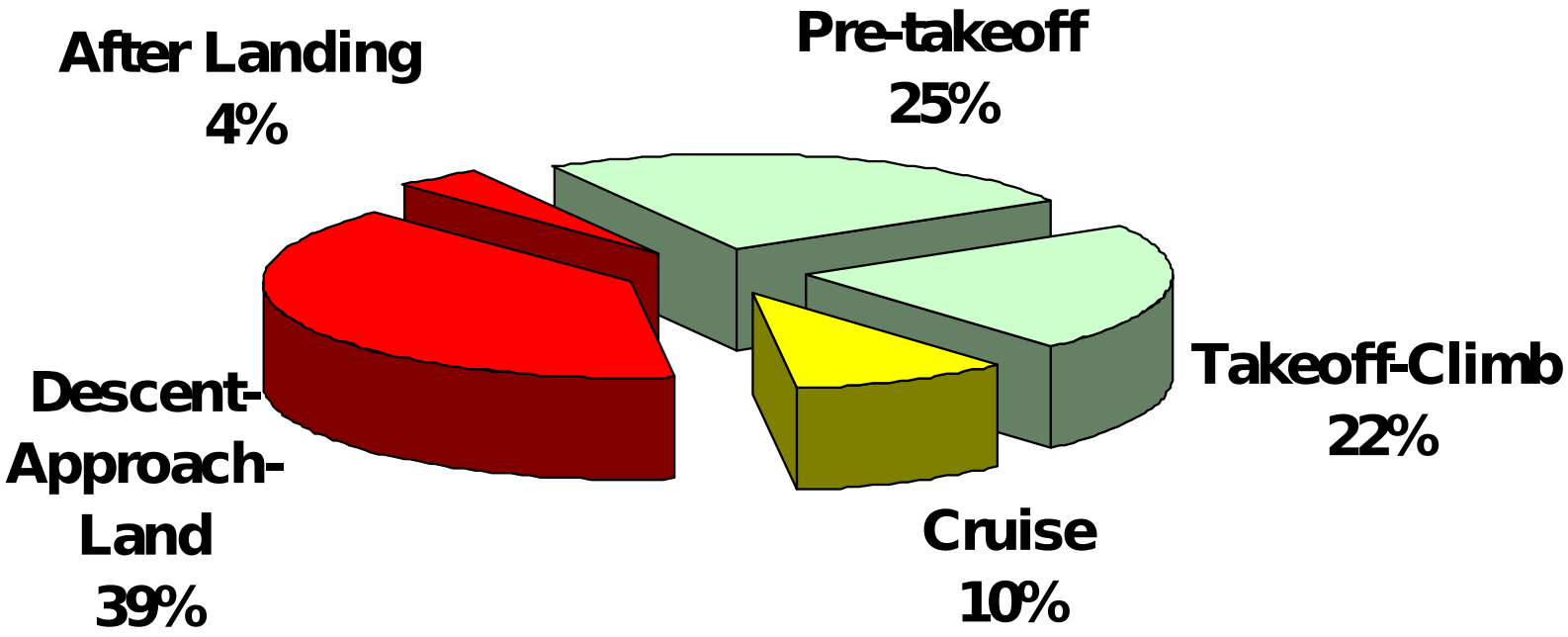


(N = 65)

Historic and Recent Causes of C-130 Class A Mishaps

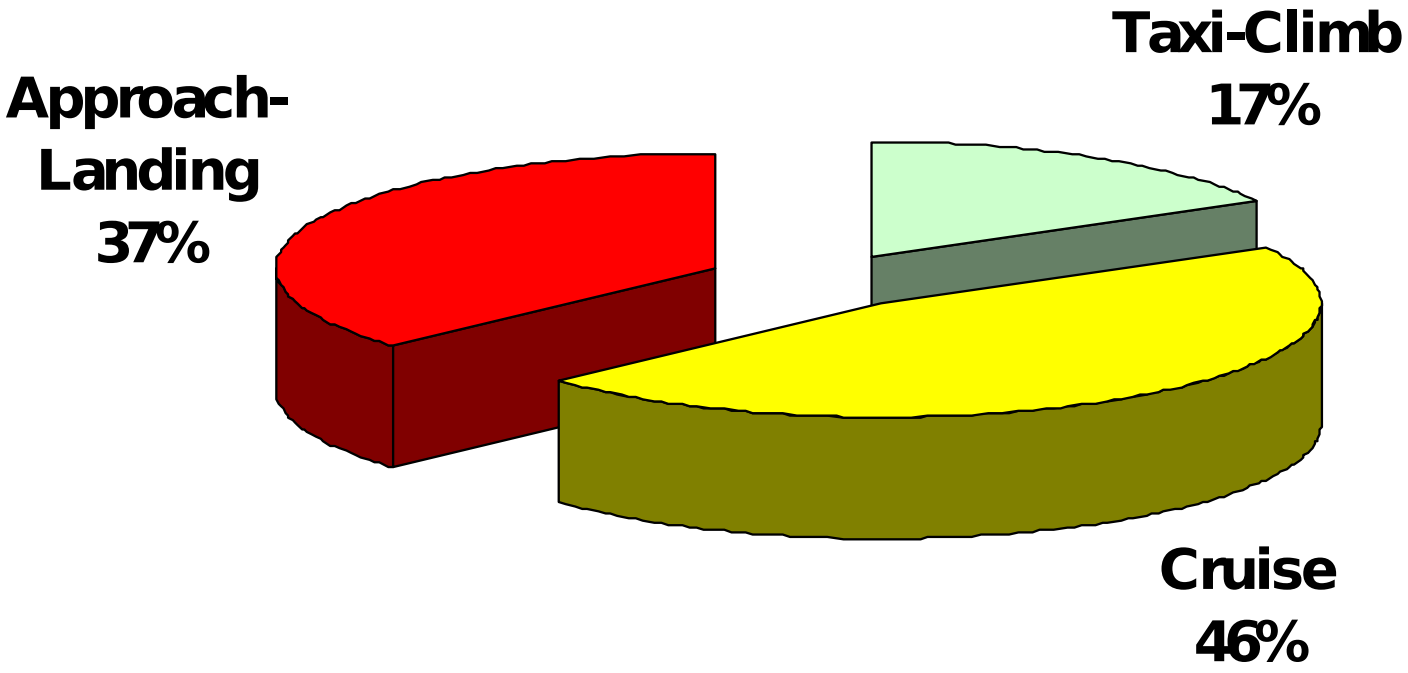


Errors in Commercial Aviation by Major Phase of Flight

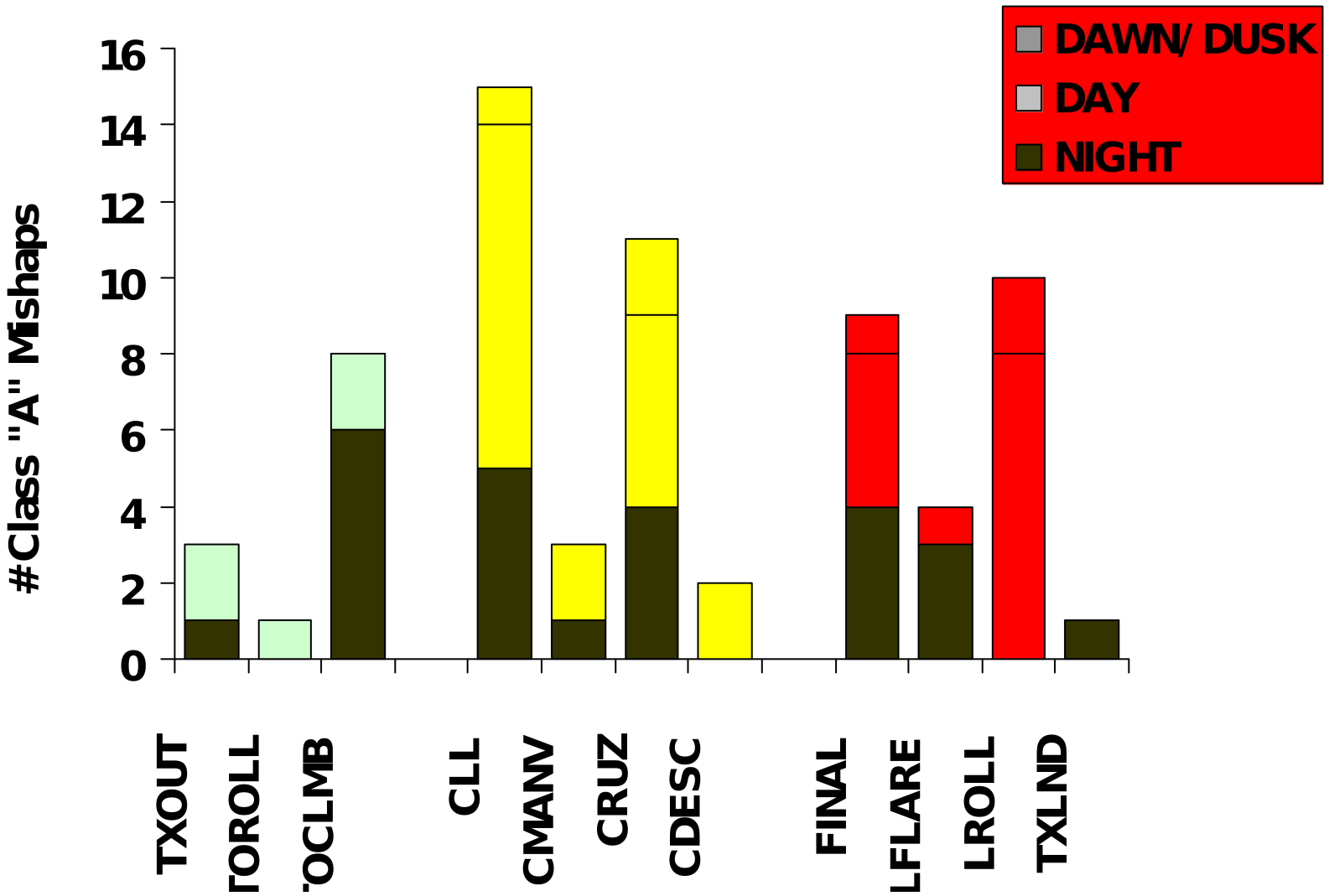


Source: Bob Helmreich, 2001. *Managing Threat and Error*,
2001 Air Force Reserve command Conference, Scott AFB IL

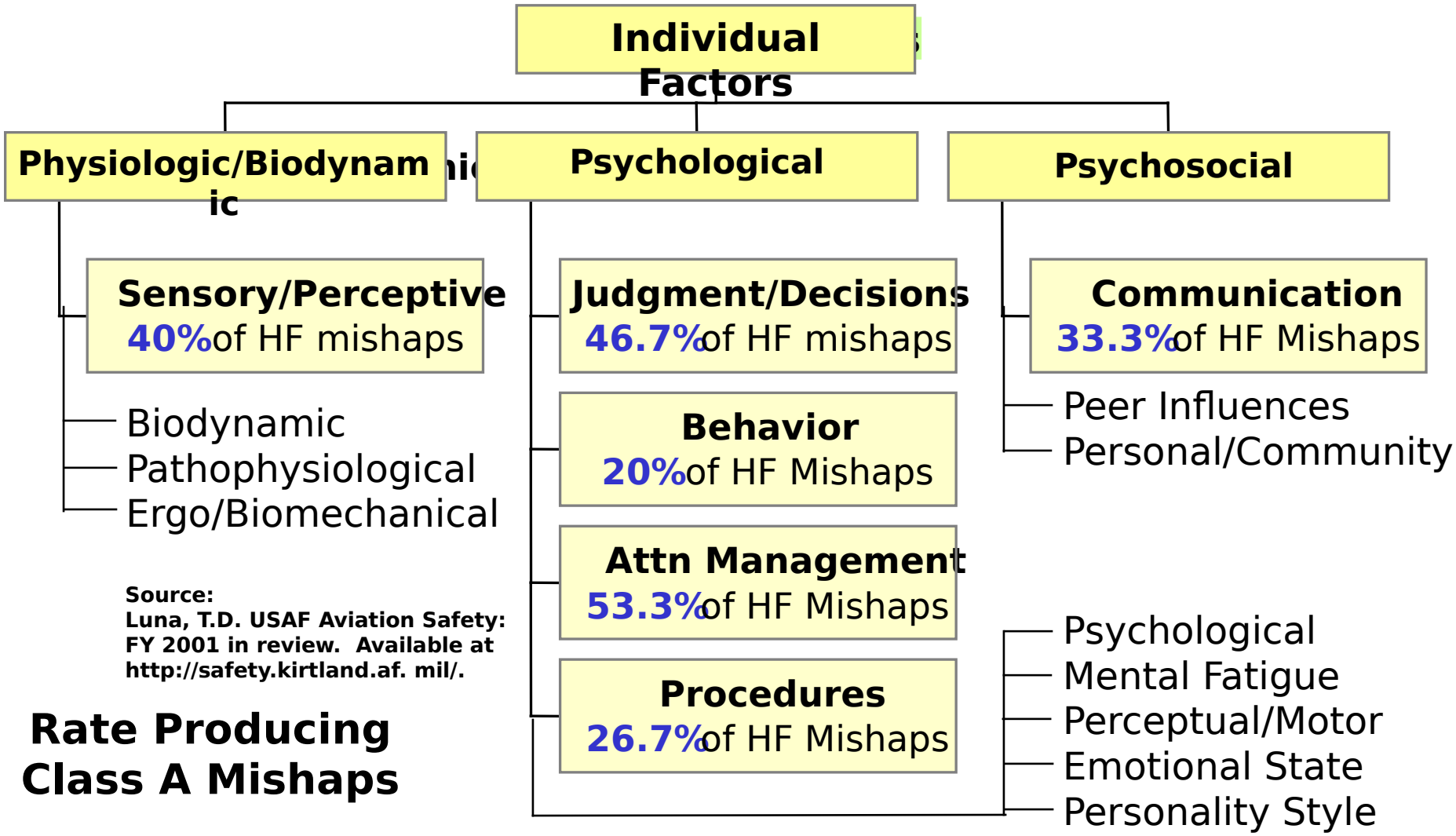
C-130 Class A Mishaps 1971-2002 by Major Phase of Flight



C-130 Class A Mishaps in 1971 - 2002 by Mission Element and Time of Day



2001 HF Mishap Breakdown: Individual Factors



Source:
Luna, T.D. USAF Aviation Safety: FY 2001 in review. Available at http://safety.kirtland.af. mil/.

Rate Producing Class A Mishaps

CRM in C-130 Class A Mishaps 1990-2002

AFI 11-290 CRM Element

Decision Making/Risk Management (12/13)

Situational Awareness (12/13)

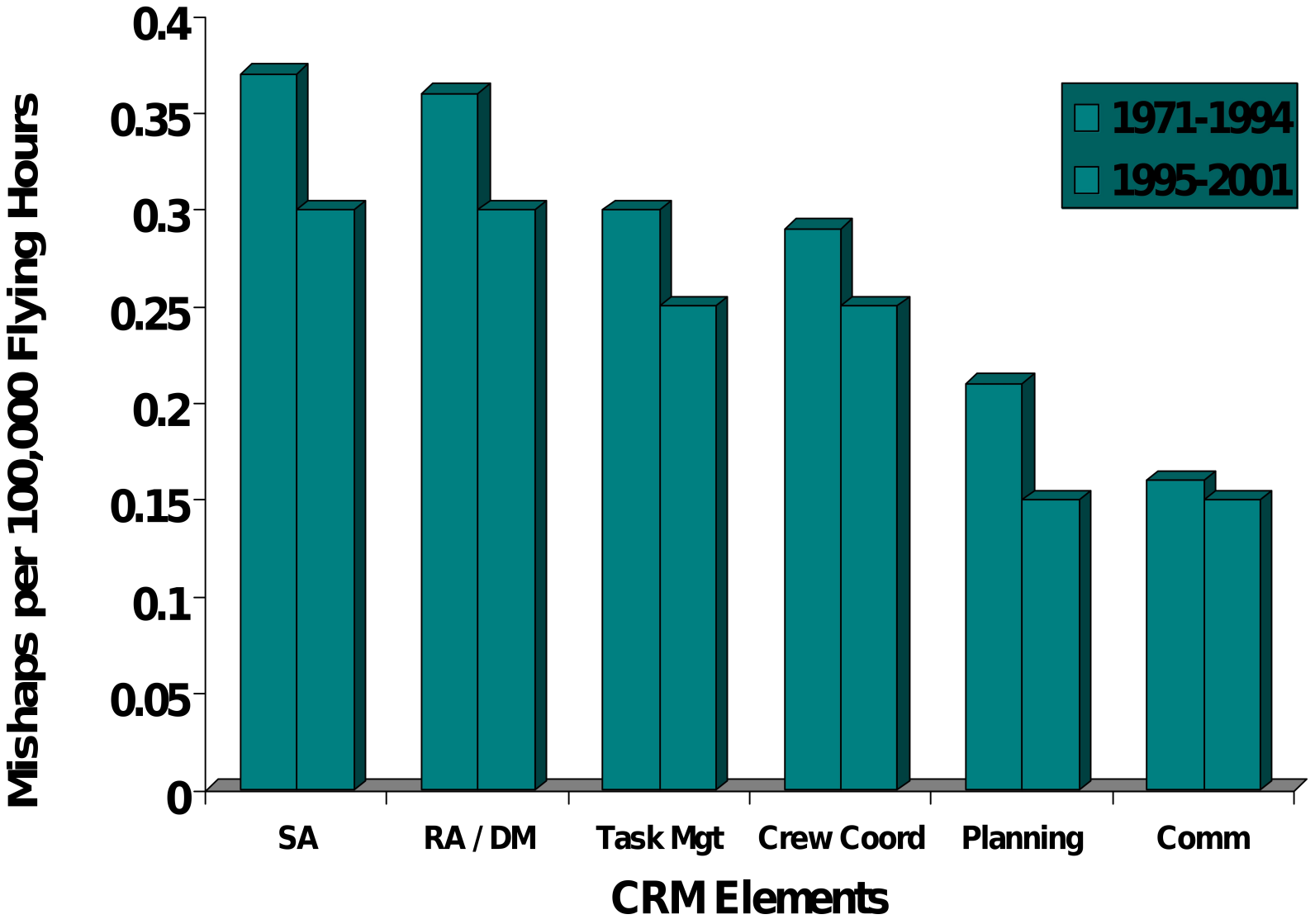
Crew Coordination (11/13)

Task/Time Management (10/13)

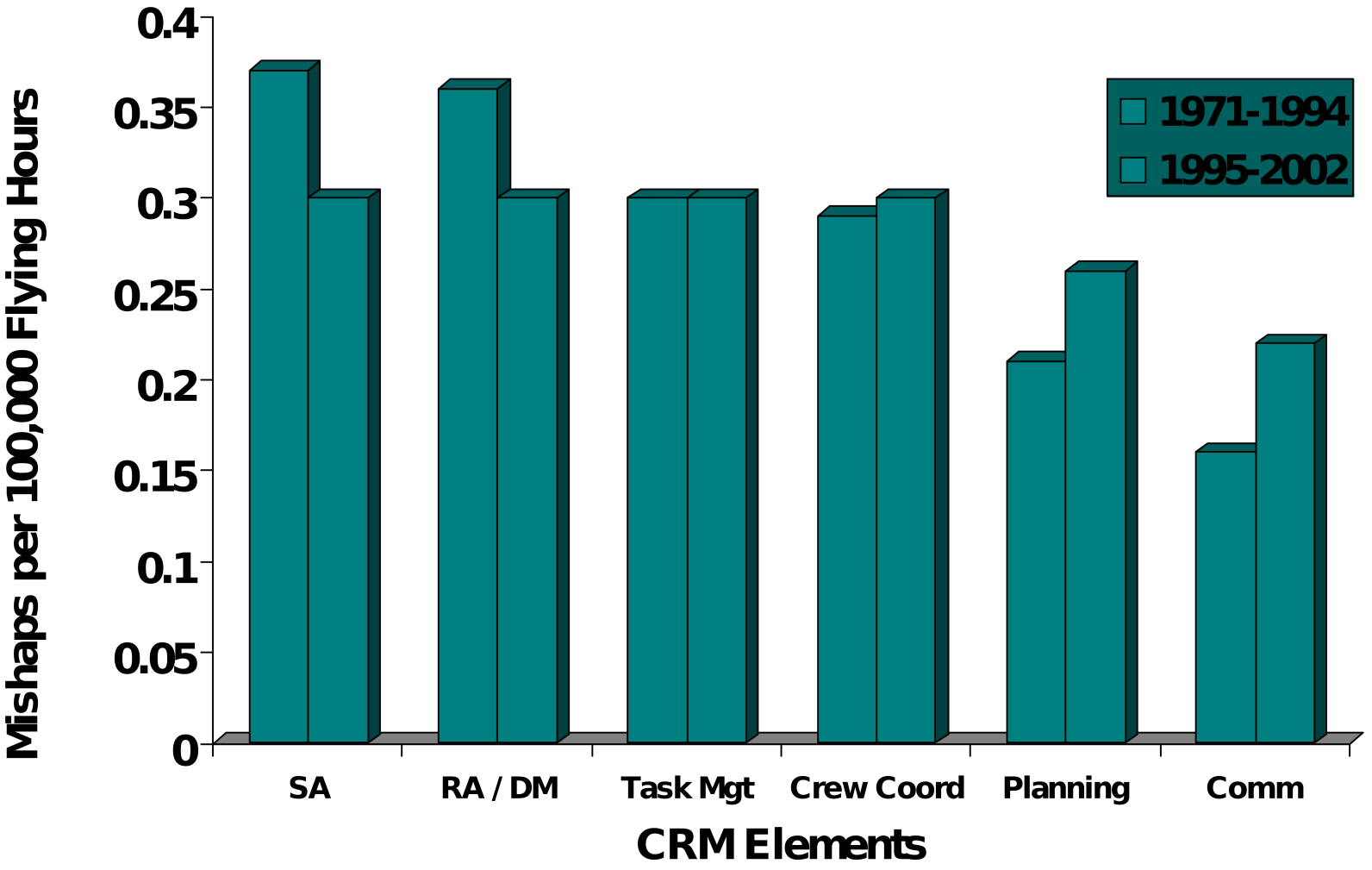
Mission Preparation (8/13)

Communication (7/13)

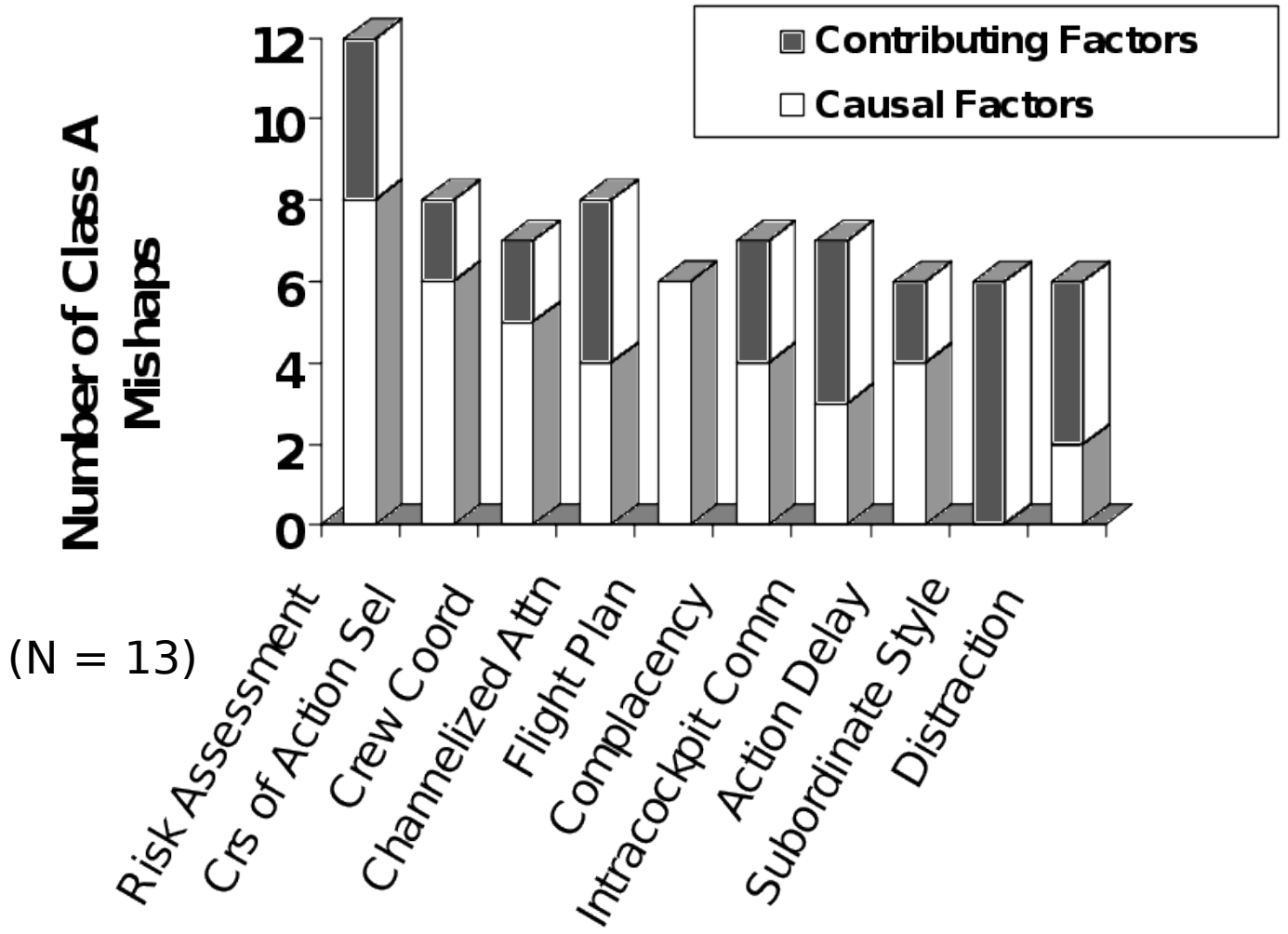
Historic and Recent C-130 Mishap Rates by CRM Elements



Historic and Recent C-130 Mishap Rates by CRM Elements



1992-2002 C-130 Class A Mishaps: "Top Ten" Specific CRM Factors



(N = 13)

Mishap Conclusions

- **Crew error still the largest cause of mishaps**
- **A finite set of behaviors caused or contributed to most C-130 Class A mishaps**
- **Clusters of related factors point to targets of opportunity for added attention in training**
  - ***Inadequate mission planning / pre-mission risk assessment***
  - ***Risk assessment / course of action selected inflight in response to unplanned condition***
  - ***Complacency / subordinate style / crew coordination / [lack of] intracockpit communication***
- **Air Force (and Navy) CRM areas remain relevant**

Instructor Comments in Student Records

- **135 C-130 student records collected covering ACQ, PIQ, CP, NAV, FE, and Load**
  - ***Instructor comments relative to human factors were highlighted***
  - ***Highlighted comments scored (positive, negative, or neutral) and categorized by SMEs using an Aircrew Performance Framework***

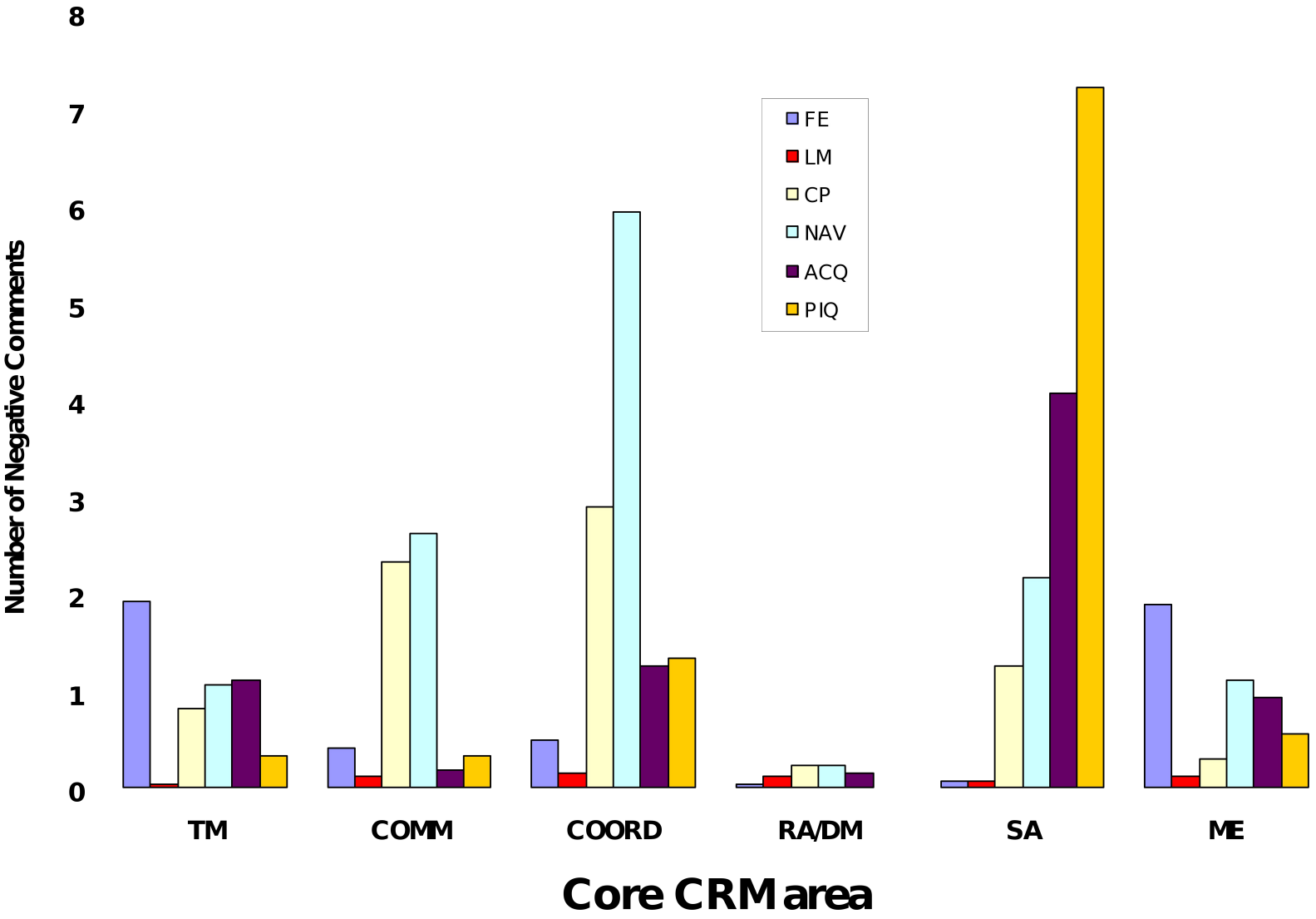
Task Management ***Knowledge***

Communication ***Crew Coordination***

Attitude ***Decision making***

Situation awareness ***Mission Evaluation***

Negative Comments from Flightline Instructors



Comparison Across Data Sources

	C-130 MOST / WST Study	C-130 Mishap Trends	Neg. Instructor Comments
Mission Planning	Highly related to mission performance	Causal in 6 of 7 recent mishaps	All positions except LM
Decision Making	Weaker-rated CRM skill area	Most frequent Mishap Cause	Very infrequent
SA	Weakest-rated CRM skill area	Most frequent contributor	Pilots-very many Navs - some
Comm / Crew Coordination	Critical data not passed	No intracockpit comm in most	CP – Many Navs–very many

Questions?

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